Construction Sites Safety in India: An Assessment Through Eyes of Workers

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Construction Sites Safety in India: An Assessment Through Eyes of Workers

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by

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May 12, 2016

Supervisors' Certificate

This is to certify that the work presented in the thesis entitled ***Construction Sites Safety in India: An Assessment through eyes of Workers*** submitted by ***Apoorv Singh Chauhan*** bearing Roll Number 214CH2521, is a record of original research carried out by him under my supervision and guidance in partial fulfilment of the requirements of the degree of M*aster of Technology in Safety Engineering* hosted by *Department of Chemical Engineering*. Neither this thesis nor any part of it has been submitted earlier for any degree or diploma to any institute or university in India or abroad.

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Declaration of Originality

I, *Apoorv Singh Chauhan*, Roll Number *214CH2521* hereby declare that this thesis entitled *Construction Sites Safety in India: An Assessment through eyes of workers* presents my original work carried out as a Master's of Technology student of NIT Rourkela and, to the best of my knowledge, contains no material previously published or written by another person, nor any material presented by me for the award of any degree or diploma of NIT Rourkela or any other institution. Any contribution made to this research by others, with whom I have worked at NIT Rourkela or elsewhere, is explicitly acknowledged in the thesis. Works of other authors cited in this thesis have been duly acknowledged under the sections "Reference" or "Bibliography". I have also submitted my original research records to the scrutiny committee for evaluation of my thesis.

I am fully aware that in case of any non-compliance detected in future, the Senate of NIT Rourkela may withdraw the degree awarded to me on the basis of the present thesis.

May 23, 2016

NIT, Rourkela *Apoorv Singh Chauhan*

Terms & Equations

- Workplace - Any physical location in which work-related activities are performed under the control of the organization.
- Worker – A person who is employed to do any skilled or unskilled manual, supervisory, technical or clerical work for hire or reward, whether the terms of employment be expressed or implied, in connection with any building or construction work.
- Audit - Systematic, independent and documented process for obtaining “Audit evidence” and evaluating it objectively to determine the extent to which “Audit criteria” are fulfilled.
- Confined Space - A workplace having limited openings for ingress or egress making it difficult for the person inside the confined space to escape freely at will. This workplace could be oxygen deficient (less than 19.5%) or oxygen enriched (more than 23.5%).
- Environment - Surroundings in which an organization operates, including air, water, land, natural resources, flora, fauna, humans, and their interrelation.
- Environmental Aspect - Element of an organization’s activities or products or services that can interact with the environment.
- Environmental Impact - Any change to the environment, whether adverse or beneficial, wholly or partially resulting from an organization's environmental aspects.
- Hazard - Source, situation, or act with a potential for harm in terms of human injury or ill health or a combination of these.
- Risk - Combination of the likelihood of an occurrence of a hazardous event or exposure(s) and the severity of injury or ill health that can be caused by the event or exposure(s).
- Acceptable Risk - Risk that has been reduced to a level that can be tolerated by the organization having regard to its legal obligations and its EHS policy.
- Risk Assessment - Process of evaluating the risk(s) arising from a hazard(s), taking into account the adequacy of any existing controls, and deciding whether or not the risk(s) is acceptable.

- Interested Party - Individual or group, concerned with or affected by the EHS performance of an organization.
- Man-hours Worked - The total number of employee-hours worked by all employees working in the premises. It includes managerial, supervisory, professional, technical, clerical and other workers (including contractor labours, security personnel & other casuals). Man-hours worked shall be calculated from the payroll or time office record including overtime. When this is not applicable, the same shall be estimated by multiplying the total man-days worked for the period covered by the number of hours worked per day. The total number of man-days for a period is the product of the number of persons engaged multiplied by the man-days worked.
- Man-days Lost - The day on which the injury occurred and the day injured person returned to the work are not to be included as man-days lost, but all intervening calendar days (including Sundays or days off or days of plant shutdown) are to be included. If after resumption of work, the person injured is again disabled for any period arising out of the injury which caused his earlier disablement, such subsequent disablement is also to be included in the man-days lost. According to the schedule of charges, a loss of 6000 man-days is taken for death of a person.
- Incident - Work-related event(s) in which an injury or ill health or fatality occurred, or could have occurred.
    - Note 1: An accident is an incident which has given rise to injury, ill health or fatality.
    - Note 2: An incident where no injury, ill health, or fatality occurs may also be referred to as a “near miss”, “near-hit”, “close call” or “dangerous occurrence”.
    - Note 3: An emergency situation is a particular type of incident.
- Near Miss Case - An incident where no injury, ill health or fatality occurs.
- Ill Health - Identifiable, adverse physical or mental condition arising from and/or made worse by a work activity and/or work-related situation
- Reportable Lost Time Injury - An injury causing death or disablement of the injured person for 48 hours or more excluding the day of the shift on which the accident occurred.
- Dangerous Occurrence - An unplanned event, which did not result in personal injury or disablement, but arising out of – 1. Bursting of a plant used for containing or

supplying steam under pressure greater than atmospheric pressure. 2. Collapse or failure of a crane, derrick, winch, hoist, or other appliance used in raising or lowering persons or goods, or any part thereof, or the overturning of a crane / vehicles / equipment. 3. Explosion or fire or bursting out, leakage or escape of any hot / cold substance (molten metal, liquid or gas) causing injury to any person or any room or place in which persons are employed. 4. Explosion of a receiver or container used for the storage at a pressure greater than atmospheric pressure of any gas or gases (including air) or any liquid or solid resulting from the compression of gas. 5. Collapse or subsidence of any floor, gallery, roof, bridge, tunnel, chimney, wall, building, excavation or any other structure or formwork or scaffold.

- Reportable Sick case - A sickness case causing disablement of the affected person for 48 hours or more excluding the day of work on which he fell sick.
- Frequency Rate –Number of Reportable lost time injuries per million man hours worked.

$$\text{Frequency Rate} = \frac{\text{Number of Reportable Lost Time Injuries X } 10^6}{\text{Man-hours worked}}$$

- Severity Rate - Number of man-days lost due to reportable lost time injuries per million man-hours worked

$$\text{Severity Rate} = \frac{\text{Man-days Lost due to Reportable LTI X } 10^6}{\text{Man-hours worked}}$$

- Frequency rate of First aid cases - Number of First Aid Cases per million man hours worked.

$$\text{Frequency Rate of First Aid Cases} = \frac{\text{Number of First aid cases X } 10^6}{\text{Man-hours worked}}$$

- Accident Rate

$$\text{Accident Rate} = \frac{\text{Frequency Rate X Severity Rate}}{\text{Risk Index}}$$

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Knowledge in itself is a continuous process. I would have never succeeded in completing the task without the cooperation, encouragement, and help provided by various personalities.

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NIT, Rourkela Apoorv Singh Chauhan

Abstract

Construction industry has been the backbone of a nation in development processes and economy. It is one of the most hazardous industry not by severity ratio but by occurrence ratio. It is the largest employer of workers after agriculture industry, thus making it more prone to accidents. Environment, Health & Safety (EHS)is an area that covers every profession and it is an integral area of the industry. The right knowledge about this can lead to human lives being saved, which is more important than properties loss. EHS empowers a worker/person regarding his work, his conduct, and his motives. EHS allows a worker to be more aware, be more cautious and be more productive. Psychological analysis can empower a worker to be more effective and productive. It increases the will power of workers, 'where there is a will, there is way'. This thesis is regarding the assessment of construction sites in India, through an eye of a worker which leads us to various revelations in the sites and thus portray the picture of how their welfare is being taken off in the industry. The study showed how a worker is dealt with various induction processes and training modules that educates him about EHS. This report also tells us the voids that have been left untouched and which play a significant role in workers' safety. These voids have been addressed in this report and solutions have been suggested along with them. The study was conducted on a observational basis which lead to psychological analysis of workers, their understanding of safety policies, their active participation in safety meetings and their meaning of training imparted to them. Psychological study answers the 5 W's (why, where, whom, who and whose) of accidents. This study recommends in the improvement and organising worker-to-safety engineer talks.

Keywords: Construction Safety; Psychological Analysis; EHS; Labour Intensive

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Chapter 1

Introduction

BOCW act states many rules & legislations that state the instructions that should be followed by employer for safety of employees. The instructions are detailed with in-depth details and are exhaustive. These details are then forwarded by employers to contractors who in turn pass it on to workers. However, with the such strong and detailed acts being present, accidents still happen at large scale. Construction industry is reported worldwide as having the highest occupational injury rates (Abudayyeh et al., 2006; Fang and Wu, 2013). Despite the existence of Occupational Health & Safety (OHS) laws, accident frequency in construction still remains at high level. As many researchers reported, the continuous unsafe conditions are mainly due to a misalignment of management commitment and subordinates' actions. (Suraji et al., 2001; Arquillos et. Al., 2012; Sunindijo and Zou, 2012; Martin and Lewis, 2014). Construction Industry is one of the largest employers in India with around 10 million employed and thus with such large numbers it is evident of the huge numbers of fatalities that occurs. Rate of fatal accidents in construction industry is 4 – 5 times higher that of manufacturing sector. It is a highly labour intensive industry and thus safety has to be comprehensively addressed in it. As per one survey, 165 out of 1000 workers get injured during construction activities.

There are many laws, acts, rules & regulations present to cater to the needs regarding safety but all these exist mostly on paper and on field scenario changes drastically. Apart from so many acts, rules & regulations introduction, the responsibility for enforcing these acts have been given to Labour commissioner. Unlike the Chief Inspectorate of factories, who shares similar responsibility to ensure safety standards in manufacturing sector and has necessary technical background experience, the Labour commissioner has a no – technical background. Construction safety, on the other hand, being a technical subject, the office of labour commissioner may not be equipped with the adequate know-how to carry out the inspection of construction sites. Unfortunately, neither Central nor State government wishes to increase their manpower or create a new department for enforcement of this legislation. In many of the construction sites, to fill up the posts as stipulated by the norms laid down

in the policies, the industries tend to fill up the posts with people not related to safety technical background thus reducing the effectiveness of the EHS policies enforcement.

EHS plays a major role in shaping the activities around the site in a construction industry. The morale of workers will remain increased if there are no fatalities in the construction site, thus increasing the productivity of the site. A safety culture needs to be developed as an integral part of work culture of an organisation where the basics of EHS will be taught and implemented by the workers before being taught about the latest technologies and as the advancement in technology happens, the need for training of workers (operators) as per latest tools, trends, and techniques to ensure safe operation of high-tech equipment's and to avoid any danger to human life has to be incorporated into the safety culture. In construction sites, since being labour intensive the technologies only aid the work and the workers, but the workers have a higher priority than the technologies as human life is more valuable than technology. Technologies can be used in aiding the worker to be more effective and cautious in EHS implementation.

The construction industry is not a homogenous sector due to its nature of work involved. All the construction industries are temporary in nature. Since they are temporary in nature, a different approach is needed to implement EHS policies for each site. Even though there is a great increase in workforce, the construction industry remains labour intensive due to financial constraints often employs hazardous technology and relatively inexpensive safety measures (Brindha, 2005).

Objective of Study -

1. To investigate in an unbiased manner, the ways in which psychological problems are handled at present.
2. To develop new methods and to modify the methods which have been tried out and evaluate them.
3. To formulate recommendations which will help in the solution of worker relation problems.

This study tends to focus on the effective implementation of EHS policies in construction sites of India. This task is achieved by direct to direct approach telling about the on-field activities whereas indirect approach leads to pattern analysis. Direct –to – direct approach is talking to workers one by one which results into discussion that the top management does not tell. Worker is the person who is directly getting involved with the accidents at first,

hence, his knowledge regarding EHS matters in necessary to understand and has to be improved. Indirect approach is going through books, journals, articles, EHS meetings, top management talks which tells about the accidents data, rate of fatality, and this approach helps in predicting a trend in the accidents. Analysis basis on this approach is very viable as data resources are available for prediction.

Main question is:

- Why do the accidents still happen after so many laws and technologies are present in exhaustive details?
- Is the implementation of the policies by contractor/employer/government are not effective?

The psychology approach here is research based rather than administrative approach based. The answers to above according to the author lies in the application of 'Human Factor theory'. Solutions are presented by psychological study which analyses the mindsets/mentality/mentality & attitudes of the workers in the following areas/sectors of the construction industry:

1. Excavation
2. Drilling
3. Piling and Deep Foundation
4. Road making
5. Site Transport
6. Floor and wall opening
7. Demolition
8. Structural and Steel erection
9. Concrete framed structures
10. Material handling
11. Compressed air area
12. Tools used
13. Constructural machinery
14. Common hazards

Psychology is the science of human mind; the study of human behaviour. Human factor is very important for the achievement of the objectives in any organisation. Human factor with

his ability to think, to feel, to conceive and to plan is most valuable and difficult element to inspire and motivate.

It has been observed by the author that the acts, rules & regulations related to EHS are forced upon the workers in the construction industry. This stops the workers will to think and thus he tries to follow the policies forced upon him by the contractor/employer.

For areas related to productivity, it may be an effective move, but for matter related to EHS, it is dangerous. Workers are human beings but in some construction industries, they are treated less humane. This treatment by the employer forces them to adapt to the laid down policies, forced to accept it rather than give valuable insights for the removal of voids or drawbacks in the policies. Workers are to be considered for the policy making scenario as they have the on – job experience more than the employer or management. This experience can be vitally used to make the EHS policies better than just making it a set of laws written down on a piece of paper.

This study aims to introduce an improvement in approach to workers Safety & Health by empowering workers to basic safety and health procedures and thus enabling them to take responsibilities in EHS matters. This study also aids in EHS effectiveness by providing training modules improvement and an analysis of worker's psychological needs. The increase in psychological nature will thus amplify the productivity of the worker and thus enlightening the worker in EHS fields.

The study has used the methodologies of doing a field study and then conducting surveys in construction sites in construction industries. Questionnaires are also used to check the views of workers regarding the matter of EHS and regarding the management.

Chapter 2

Literature Review

Act – It is an instrument that records a fact or something that has been said, done or agreed. The common types of acts are Legislative, Judicial, and Notarial. Notarial are further of two types – Act in Public form and Act in Private form.

Rule – They are standard sets of instructions, informally called as law. Laws are the legal version of rules or system of rules.

Regulation – It is a legal norm intended to shape conduct that is a by-product of imperfection. A regulation may be used to prescribe conduct ('command and control regulation'), to calibrate incentives ('incentive regulation'), or to change preferences.

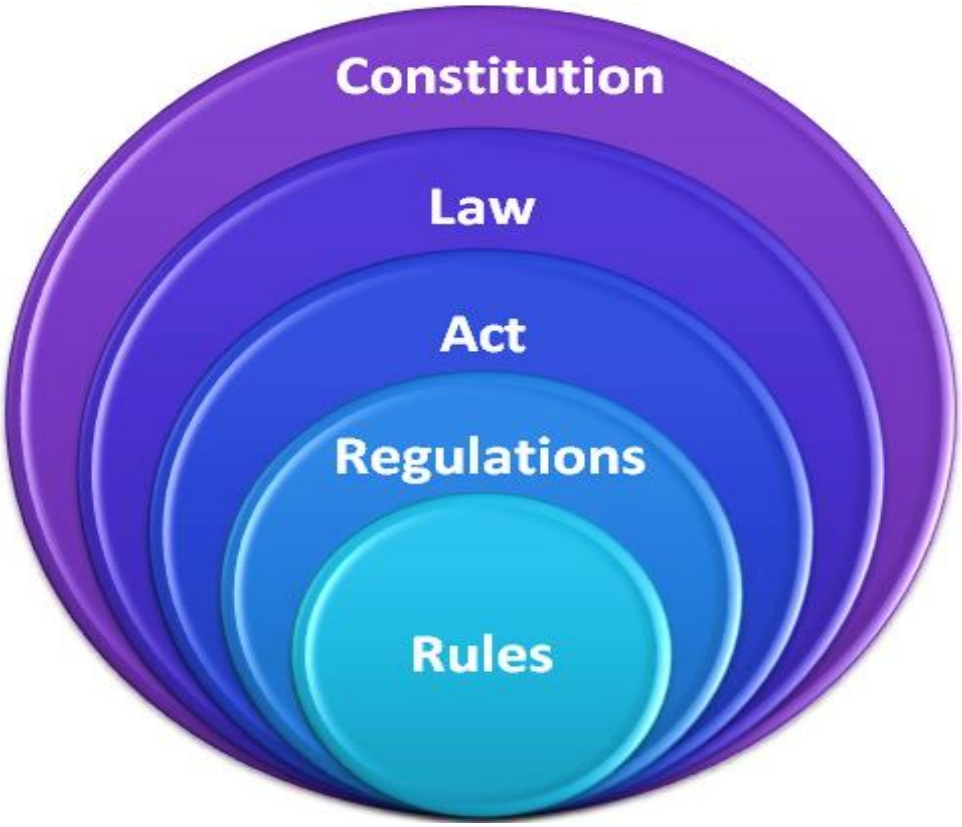

Figure 2.1 Difference between Acts, Rules & Regulations

Meswani, Hital R (2008) said that Acts, Rules & Regulations provide any organisation the framework to proceed with work as in this era of Globalisation, due to intensive competition in market, consumers are now giving emphasis on product with EHS standards.

Fong D (1999) said that humans have a tendency to commit mistakes and thus stringent measure are required to keep it in check. The nature of humans depends or is influenced by various factors like moral, social, personal, psychological, etc. Policies are to be made keeping these factors in mind.

Walter and Frick (2000) stated, 'With the growing market of OHSM systems, psychologists now try to reintroduce behaviour as the main risk factor to control such systems'.

These are known as the Framework Regulations as they create broad and general duties on employers, employees, and the self-employed. The aim is to improve health and safety management and to make more explicit what is required from employers. A more systematic and better-organised approach to health and safety is being encouraged. Therefore, a company that is operating a health and safety management system encompassing the duties under the Health and Safety at Work Act and the Framework Regulations should be able to comply with any future safety directives that are enforced.

Mohamed, Sherif (2001) stated that relationship between safety climate and safe work behaviour in construction site is governed by regulations laid out which results in enhanced productivity.

Jaselskis, E., Anderson, S., and Russell, J (1996) stated that strategies for improving construction safety performance is essential and has to be upgraded in management systems leading to removal of obscurities.

Kartam, N (1997) stated that computerised safety enhancement leading to enhanced critical path method (CPM) integration and performance is to be incorporated in OHSAS.

Laitinen, Marjamäki, and Päivärinta's (1999) stated that many proactive safety observation techniques have been developed over last few decades, few of them have shown to be predictive of accidents.

Mikkelsen, Spangenberg & Kines (2010) stated that safety index provides a proactive measure of physical and behavioural safety level at work site (percent correct vs incorrect

safety observations), as do 'traffic light' observation systems that rate safety conditions/behaviour as red – high risk, yellow – medium risk, green – low-risk.

In spite of these positive results, there is still uncertainty as to how to effectively motivate and provide positive feedback at construction worksites for the decrease in the rate of fatality.

Zohar (2008) stated that a number of studies provide evidence showing that the aspects management prioritize have a spillover effect on worker's attitudes and behaviours.

Hofmann, Morgeson & Gerras (2003) stated that studies regarding leader – worker exchanges and safety communication, safety climate, and safety citizenship have used questionnaires focused on social exchange theory and measuring the quality of exchanges. They found that leader – worker exchanges tended to stimulate employees to raise safety issues.

Stajkovic and Luthans (2003) performed a meta-analysis which indicated that supervisory feedback and recognition were amongst the most powerful incentives influencing job performance. Daily supervisory feedback regarding safe and unsafe behaviour and conditions provides an indication of the true priorities between production and safety, particularly when work is performed under extreme time pressure.

In India, departments under the Ministry of Labour and Employment deal with OSH issues in construction sector under the head of Chief Labour Commissioner. Directorate General Factory Advise Service Labour Institute (DGFASLI) provides technical support in drafting model rules, carrying out surveys, and conducting training programmes in construction sector.

Chapter 3

Methodologies

The psychological studies in the industry are study of the people at work or in industry, regarding their attitude and qualification of the jobs. It is always primarily the study of people as individuals or as a group as in the work study.

1. The study is concerned with the information relating to the human behaviour. It is concerned with the application of information about human behaviours to the various problems of human life. i.e. human relations, mental health of the workers on the job, ways to uplift the mood of the workforce.
2. It is also concerned with the aspect of the work environment like lightning, temperature and their effect on output and safety of worker.

The above is understood by following the below laid down ideas:

1. *Understanding of (Major) Accident Prevention* - This is about identifying hazards and risks and about selection and training of people so that they understand the risks and what to do about them and ensuring they have the right roles and responsibilities for controlling the risks. Failure to do these things leads to mistakes leading to an accident trigger.
2. *Competence for tasks* - Ensuring people who are involved with risk control tasks have the appropriate competencies for those tasks. Training inadequacies and lack of competence can cause an essential element of control to be absent when a demand is made on the risk control system.
3. *Priorities, attention & conflict resolution* - Getting worker involvement and communications about inadequacies of job and equipment design so that demand-capacity mismatches can be fixed. Mismatch failures like excessive workload can result in tunnel vision and divert attention away from safety.
4. *Assurance* - Ensuring that standards and procedures get used. Sometimes, the organisation fails to update its own knowledge base. Sometimes, a standard (such as from external sources) is overlooked or thought not to apply, or it is lodged with someone in a different position in the organisation and so distanced from the persons who need it. Aspects like modifications or organisational change may exacerbate this problem or create the opportunity for this organisational weakness to be realised.

The Questionnaire:

The questions in this questionnaire were constructed from various day to day observation in metro rail construction and building construction sites. The question was constructed personally only and no public help or opinion was taken. The questions are solely for the categories of people involved in the sites. The questions were asked from workers, contractor, chief EHS manager and lastly project manager. Their responses were recorded on a sheet and kept secret for this study to avoid biases and modification.

Table 3.1: Questionnaire

Questions	**Workers**	**Contractors**	**Chief EHS manager**	**Project Manager**
Have you received any training regarding safety in construction site?	2	3	4	4
Has any EHS Officer/Engineer approached you regarding EHS related matters?	2	3	4	4
How frequent have you encountered or witnessed any unsafe act or unsafe accident in site?	4	2	3	1
Do you participate in the EHS meetings held with workers?	2	3	4	4
How is the bonding between you and EHS officer/engineer of the site?	2	2	4	3

Scale –

5 – Superactive

4 – preactive

3 – Active

2 – Semiactive

1 – Nonactive

The above scale represents the activeness of the Worker/Contractors/Chief EHS Manager/Project Manager.

This activeness is in terms of EHS activities implementation and understanding, regarding the concern and more importantly the effectiveness of safety policies.

This questionnaire shows the workers knowledge regarding EHS matters on the site.

Chapter 4

Analysis

Construction worker's attitudes towards safety are influenced by their perceptions of risk, management, safety rules and procedures. Worker’s tends to pay more attention to EHS matters if they are given responsibility in that matters and their though thinking process changes for the good. Workers show a positive mindset and are more willing to talk and discuss on the matters of EHS than before. The above studies showed a trend of attention being visible in the worker’s ideas and talks. The study showed the human factor influence being able to be taken care of, but since no human is perfect, therefore it is suggested to repeat the above task time to time as regular practice in areas of EHS is as necessary as having meals thrice a day.

Worker’s attitude and behaviour discernible in safety climate, which can be regarded as micro – elements of an organisation, whereas safety management system and practices, are considered as macro elements of an organisation.

The worker’s attitude regarded as micro - elements is trained and looked after as they are the ones who face the accidents maximum. Most focus has been shifted from macro elements to micro elements to improve the safety culture of the construction sites in India.

India being a labor intensive industry has been recommended to focus on implementation of laws rather than creating new ones. India has one of the toughest laws on paper, but reality is mirror image of it.

The following code of practices can be included for workers and contractors -

1. No workmen below 18 years and above 55 years of age shall be engaged for job.
2. All workmen shall be screened before engaging them on the job. Physical fitness of the person to certain jobs like working at height or other dangerous locations to be ensured before engaging the person on work. The final decision rests with the site management to reject any person on the ground of physical fitness.
3. Smoking is strictly prohibited at workplace.

4. Sub-contractors shall ensure adequate supervision at workplace. They shall ensure that all persons working under them shall not create any hazard to self or to co-workers.
5. Nobody is allowed to work without wearing safety helmet. Chinstrap of safety helmet shall be always on.
6. No one is allowed to work at or more than 2m height without wearing safety harness and lanyard of harness shall be anchored to firm support preferably at shoulder level.
7. No one is allowed to enter into workplace and work at site without adequate foot protection.
8. Usage of eye protection shall be ensured when workmen are engaged for grinding, chipping, welding and gas cutting. For other jobs, as when EHSO insists eye protection shall be used.
9. All PPE like shoes, helmet, safety harness etc. shall be arranged before starting the job as per recommendation of EHSO. PPE noncompliance may attract penalty.
10. All excavated pits shall be barricaded and barricade to be maintained till the backfilling is done. Safe approach shall be ensured into every excavation.
11. Adequate illumination at workplace shall be ensured before starting the job at night.
12. All the dangerous moving parts of the portable / fixed machinery being used shall be adequately guarded.
13. Ladders being used at site shall be adequately secured at bottom and top. Ladders shall not be used as work platforms.
14. Erection zones and dismantling zones shall be barricaded and a signalman to be posted to ensure that nobody stands under suspended load.
15. Horseplay is completely prohibited at workplace. Running at site is completely prohibited, except in case of emergency.
16. Materials shall not be thrown from heights in any case.
17. Other than the electricians with red helmet no one is allowed to carry out electrical connections, repairs on electrical equipment or other jobs related thereto.
18. Power supply shall be taken through RCCB of 30 mA sensitivity.
19. Insertion of bare wires for tapping power from electrical sockets is prohibited.
20. All major, minor accidents and near misses to be reported to Site Engineer / EHSO to enable the management to take necessary steps to avoid recurrence.

21. All scaffoldings / work platforms shall be strong enough to take the expected load. The width of the working platform and fall protection arrangements shall be maintained as per recommendation of EHSO.
22. All tools and tackles shall be inspected for use. Defects to be reported immediately. No lifting tackle to be used unless it is certified by the concerned P&M engineer / EHSO.
23. Good housekeeping to be maintained. Passages shall not be blocked with materials. Materials like bricks shall not be stacked more than 1.5m height.
24. Debris, scrap, and other materials shall be cleared from the workplace time to time and at the time of closing of work every day. Scrap bins provided at site shall be used.
25. Sub-contractors shall ensure that all their workmen are following safety practices while traveling in the company's transport and staying at company's accommodations.
26. Adequate firefighting equipment shall be made available at workplace and persons are to be trained in firefighting techniques with the co-ordination of EHSO.
27. All unsafe conditions, unsafe acts reported by site Supervisors and EHS personnel shall be corrected on priority basis.
28. No children shall be allowed to enter the workplace.
29. Female workers are not allowed to work at height and other high-risk areas.
30. Hydra cranes shall not be engaged for construction activities.
31. Other than the driver, nobody is allowed to travel in tractor / tipper / truck.

Chapter 5

Recommendations

It is recommended that owners and contractors should cultivate charisma and the ability of being influential about ideas in project managers and require them to be role models for others. Caring dimension of leadership is required in frontline environment. Supervisors need more attention and support from the contractor in their well-being and organisational identification for the project. Clear leadership impacting paths from owners to site supervisors of subcontractors in construction projects, to provide insights into effective ways to implement managerial measures and publicise policies and values to construction sites. Education and Training are the rewarding application of conducting a psychological study.

For psychological issue of worker –

Measurement of workers' mental workload provides an alternative source of information about on-site safety conditions. This assessment can enable project managers to identify vulnerable individuals and thus supplement the on-site risk detection. Integrating both perspectives could help project managers to prioritize the safety resources to protect vulnerable individuals who are exposed to higher risks. The proposed framework would be to enable the possibility of quantitatively assessing the mental demands of construction activities since nearly all complex construction work can be broken down into relative simple and interdependent tasks.

For improvements from the questionnaire –

1. Safety Influence and Role Modelling:
    - Make subordinates feel proud of their work and confident about safety improvement.
    - Talk about their safety values to subordinates frequently.
    - Never sacrifice safety to meet other needs & requirements

- Show a good model to obey safety rules & regulations.
- Always take major responsibilities when safety problems arise.

2. Safety Motivation and coaching:
    - Talk about safety visions clearly and enthusiastically.
    - Seek different viewpoints and perspectives on safety to avoid arbitrary decisions.
    - Suggest innovative ways and procedures for safety management.
    - Facilitating safety coaching and learning all through the project.
    - Encourage subordinate's participation in safety decision-making.
3. Safety Caring and individual respect:
    - Actively care about subordinate's everyday life and try to satisfy their need for safety and wellbeing.
    - Are confident of subordinate's safety competence and provide sufficient resources for them.
    - Pay special attention to onsite safety.
    - Are impartial and maintain harmony between different departments when dealing with safety business.
4. Safety controlling and performances management:
    - Order subordinates to accomplish safety goals and work with them for goals firmly.
    - Establish safety responsibility system of whole project personnel and review its implementation regularly.
    - Amend and update safety regulations regularly and timely.
    - Deal with near miss and safety unconformities proactively and thoroughly.

- Reward and punish moderately and legitimately to consolidate safety controlling.

5. Management commitment:
   - Upper management encourages safety improvement suggestions and provide corresponding incentives.
   - Upper management actively and decisively require to correct safety problems.
   - Upper management constantly and decisively require and motivate all onsite staff to work safely.
   - Upper management seek advice of onsite staff when safety procedures and rules are developed or reviewed.
   - Project prepares sufficiently for safety emergencies.
6. Safety management system:
   - Safety rules and procedures are able to prevent or mitigate all kinds of accidents.
   - Safety rules and procedures are reviewed and updated timely and regularly.
   - Safety rules and procedures have high feasibility and are easy to follow.
   - Safety rules and procedures are strictly followed.
   - Safety rules and procedures can guarantee safety absolutely.
7. Communication:
   - Upper management clearly communicates safety issues to all levels within the project.
   - Upper management listens to and acts upon feedbacks from onsite staff.
   - Everyone can make comments and present opinions on safety issues based on their perception of safety policies.
8. Safety involvement:
   - Everyone aims to achieve high levels of safety performance.

- Everyone actively reports safety accidents and potentially hazardous situations.
- Everyone is willing to participate in safety planning if being asked.
- Everyone contributes to job safety analysis.

9. Safety training:
    - I fully understand current and relevant safety legislation.
    - I am capable of identifying potential hazardous situations.
    - I am capable of using relevant protective equipment and tools.
    - I receive adequate training to perform my job safely and coach others.
10. Supervisory and supportive environment:
    - My colleagues and I help and support each other on safety issues.
    - I am able to effectively communicate with other on safety issues.
    - I regard my supervisor as role model in behavioural safety and safety management.
    - People can always get equipment needed to work to safety rules and procedures.
    - Safety inspection in project is very helpful to improve
    - workers' safety.

Chapter 6

Conclusions

Greatest improvements in efficiency result from training to the workers, foreman, and executives. Successful accident prevention, formation of safety and health habits, development of efficient methods of work follow are the results of application of psychology into the organisation.

Following points conclude the said sentences-

1. Selection of Placement of personnel – Various systemic tests can be put to use to select the right person for the right job. Tests like intelligence, aptitude, interest, dexterity personality tests, etc. These tests can lower the rate of labour turnover, high productivity, and higher job satisfaction.
2. Training and Development – psychology helps in devising the training needs of employees. Training techniques like teaching machines, programmed learning, sensitivity training, role playing can aid in the training modules of organisation.
3. Performance Appraisal – Psychology aids in appraising the worker by rewarding him due to his performance by conducting a monthly award as best EHS employee, or awarding him the badge of Safety concerner of the zone.
4. Determination of Wage structure – The financial matter plays an important role in a worker's life and thus determination of correct wage structure will boost his morality and his productivity.
5. Motivation of personnel – The workers are motivated regarding their job scenario and are encourages to talk to a psychologist/safety engineer regarding their job profile and improvements they seek. These talks motivate the workers that the management is with them, concerned for them.
6. Vocational Guidance and counselling – This scenario helps in finding the workers right type of jobs and to cater to their personal problems, as family problems can severely affect the job they do.
7. Improvement of Morale – The morale is improved by conducting talk sessions with the safety engineers/psychologist which deals in understanding the attitudes and their mental diagram regarding the job.

8. Human Engineering – It is concerned with the designing and laying out of equipment in order to get the greatest efficiency of man-machine system.

Scope for further Research –

The above said study was conducted on a observational basis only and thus there are many research areas left untouched. There is always scope for improvement and thus, the author requests the readers to provide or add any constructive question or comments further. The comments will be very helpful in developing a record of viable inputs and important mindsets of workers. Research can be conducted on human factor modelling, human factor analysis and human psychological thinking. The effectiveness of EHS policies depends on worker psychological analysis mostly as this is the most critical part of workers.

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